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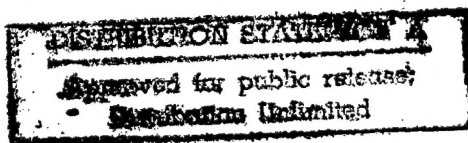
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LATERITIC SOILS IN KIANGSI

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LATERITIC SOILS IN KIANGSI

[The following is a full translation of an article submitted by the Land Utilization Bureau of the Kiangsi Agriculture Department appearing in Ti-li Chih-shih (Geographic Knowledge), Peiping, Volume IX, No 10, October 1958, pages 451-455.]

I. Preface

Lateritic soils occupy a very extensive area in Kiangsi. They are found almost everywhere in the province with the exception of the following areas: the south shore of the Yangtze River, both sides of the lower reaches of the Kan Chiang, the plains area surrounding Lake Po-yang and the highland areas in the northeast and the northwest of the province.

According to survey results, lateritic soils cover an area of about 120 million mou in the entire province, or amounting to about 46 percent of the total area. Of the waste lands in the lateritic soil areas, more than 13 million mou have an inclination of less than 25° and are suited for agricultural reclamation. They are mainly distributed in the hilly lands along the route of the Chekiang--Kiangsi Railroad, at an elevation of 30 to 60 meters above sea level.

Most of the waste lands are level, concentrated in large tracts and easily accessible. As such they are well-suited for mechanized farming and the establishment of large-scale State-operated farms and other reclamation farms of a collective nature.

II. The Nature of Lateritic Soils

The lateritic soils in China are a type of soil developed south of the Yangtze River in areas where high temperature and heavy rainfall prevail. In such a climate, most of the basic contents (such as potassium, sodium, calcium, magnesium, etc.) of the soil have been removed by rain water; the iron and aluminum contents of the soil, on the other hand, show a relatively marked increase; the decomposition of organic matter is rapid. Under the circumstances, the soil profile in these areas is brownish red or yellowish red in color--hence, the name "lateritic soils."

The area covered with lateritic soils is very extensive in Kiangsi, because the province is under the influence of high temperature, abundant rainfall¹, very rapid decomposition of organic matter, and very strong leaching in the soil. These lateritic soils differ in character, however, because of the differences in topography, vegetation, and parent material.

Generally speaking, in mountain areas of strong relief and dense forest, the humus content of the soil is higher, because of good vegetation covering, weak erosion and better water-retaining capacity of the soil. The parent material of the soil mainly consists of weathered granites, phyllites and limestones. This type of soil, dark grayish in color, is more fertile and is generally known as podsolized red earth or podsolized lateritic soil.

The lateritic soil in the level and treeless areas is derived from parent material of weathered debris mainly from Quaternary red earth and Tertiary red sandstones. At present, woody plants are very rare in these areas. In areas untouched by man's destruction, there exists a very luxuriant growth of various grasses and the soil is generally called soddy red earth or soddy lateritic soil.

¹/ In Kiangsi Province, the mean annual temperature is 18°C, the absolute maximum temperature, 40.5°C, and the absolute minimum temperature, -8.4°C. The annual rainfall is 1,800 mm; the daily maximum rainfall, 158mm. April to June is the rainy season and July to September, the drought season. The relative humidity is 75 percent, the annual evaporation capacity, 1,200mm, and the frost-free period varies between 280 and 300 days.

In the lateritic soil areas where vegetation coverings have been destroyed and where the erosion of soil and water is rife, the soil horizon is generally thin and the growth of grass is sparse. This soil is known as young red earth or eroded lateritic soil; it is very low in fertility and widely distributed over various landforms.

At present the agricultural reclamation of waste land undertaken by Kiangsi takes place mainly in these large areas of soddy lateritic soil on gently sloping hills. The profile of the soddy lateritic soil shows the following characteristics:

The soil horizon is more than one meter thick.

The topsoil (0 to 15 cm) is yellowish dark brown with abundant roots. A humus layer 3 to 5 cm thick covers the surface. The soil is medium clay loam in texture and slightly granular in structure.

The subsoil is bright red or yellowish red in color. It is still loose and has a fine granular structure. The boundaries between the horizons are not distinct.

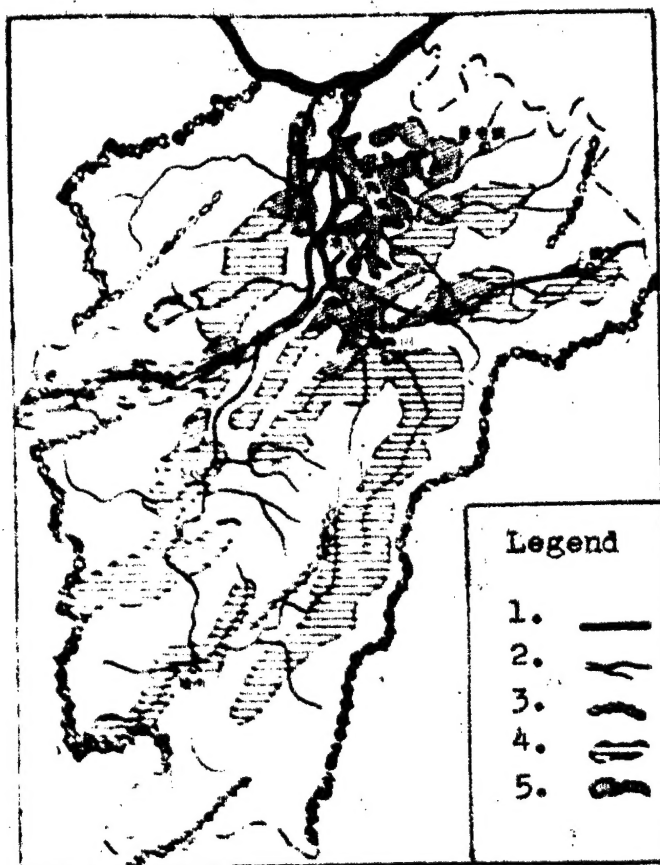
The substratum (90-120 cm) is reddish brown and quite firm.

Below 120 cm a small amount of iron-manganese concretions occurs with sparse roots.

The chemical analysis of the soil is as follows (soil sample from the State-operated Liu-chia-chan farm):

Depth (cm)	pH (KCl)	Organic Matter (%)	N (%)	P ₂ O ₅ (%)	K ₂ O (%)
0--20	4.6	0.5196	0.0414	0.0333	0.4511
30--50	4.6	0.4308	0.0326	0.0303	0.4914

Figure 1. The Distribution of Reclaimable Waste Lands in the Principal Lateritic Soil Areas of Kiangsi



Legend

1. Railroads
2. Rivers
3. Mountain Ranges
4. Lateritic Soil Areas
5. Reclaimable Waste Lands

The varieties of lateritic soils may differ in their pedogenic processes and localities of occurrence, but from the standpoint of agricultural production their differences in character are not very pronounced. They have the following three common characteristics:

(1) The soils are highly acid, deficient in organic and other available nutrients and low in natural fertility.

The acidity of the lateritic soils in Kiangsi generally varies from pH 4.0 to 5.5. The organic content of the soil is always below one percent; the total nitrogen content is about 0.5 percent; the content of the readily available phosphate is less than one part per million. The content of the readily available potassium is higher and is about 10 chin per mou.

Therefore, in the cultivation of the various crops in the reclaimed lateritic soils, organic, mineral and chemical fertilizers must be applied in order to assure a steady yield.

(2) The soil structure is bad; hence, the soil is difficult to cultivate, poor in water retention and fertility and readily eroded or washed away.

All lateritic soils do not possess a good granular structure. In heavy rain, they become muddy and heavy; in fair weather, they are hard and platy. The people describe this undesirable change of structure as "a sharp razor under the sunny skies and a terrible mess in the rain." Therefore, after these lateritic soil areas have been opened up, cultivation on these lands will still be difficult.

Besides, water retention by these soils is poor, thus resulting in a severe loss of both water and soil. Experiments have proved that in a natural waste land with a 30 percent vegetation cover, the run-off of water is 1,386,300 liters per hectare and the amount of soil washed away is 4,004.3 kilograms per hectare.

(3) The hilly areas are deficient in water supply and thus are subject to drought and reduced production.

Even though the annual precipitation in Kiangsi is as much as 1,800mm, its distribution throughout the year is, nevertheless, most uneven and every autumn brings threats of drought. In these hilly areas covered with lateritic soils, irrigation is difficult and the yield of crops is most irregular, because the topography of these areas is not favorable to the storage of water and irrigation.

The irrigation experiments on the cotton fields in the lateritic soil areas would serve as a very effective illustration in this respect. The yield of "Tzu" cotton [literally, cotton with seeds] is 300 chin per mou for small irrigated fields and only 58 chin for small non-irrigated fields; the difference in production is five-fold.

On the other hand, these lateritic soil areas offer certain particularly advantageous conditions such as warm climate, abundant rainfall, a long frost-free period, rapid growth of vegetation and rapid accumulation of organic matter. After these lateritic soil areas have been opened up, it is possible to have five harvests in two years, or three sowings and three harvests in a year; however, this can be achieved only through continual improvement and utilization. The potential productive power of these soils is very great.

III. Lateritic Soils Are Not Barren Lands

Before the liberation, because of the lack of interest in agricultural production on the part of the reactionary regime, no concerted effort was ever made to develop the resource of this vast expanse of lateritic soils.

Instead, the regime made capital of the defects of the lateritic soils and indulged in propaganda to the effect that "the lateritic soils were barren areas" and that "they were red deserts," evidently meaning that these lateritic soil areas were worthless for reclamation purposes.

After the liberation, the Party and the State decided to exploit, according to plan, that vast resource of these lateritic soils in order to develop production and to improve the people's standard of living.

Since 1950, in accordance with the spirit of the directive of the Central Committee, which calls for a vigorous development of industrial crops and animal fodder without competing with food-grains and cotton for land, the agricultural agencies of Kiangsi have

started to summarize the experience of the masses in the utilization of lateritic soils; on this basis, they have carried out a number of experiments and research work in the combined interests of agriculture and animal husbandry.

Hence, during the past six or seven years and up to 1957, more than 2,420,000 mou of waste lands throughout the province were transformed into cultivated fields, as a result of the correct guidance of the Party and State organs at various levels, and also as a result of the positive efforts of the peasants throughout the province.

In 1956, in order to meet the increasing demands resulting from the continual development of reclamation work, Kiangsi formally established land utilization agencies, which have since supervised work projects concerning the waste lands, such as reconnaissance surveys, formulation of projects, soil improvement, land planning, etc.

At the same time, more than 30 large-scale State-operated red earth farms were established. This year the mission of the various farms is to open up 300,000 mou of waste land. Under the impetus of the Big Leap Forward, the over-fulfillment of this target is almost a certainty.

During the past few years the various State-operated farms have planted on the lateritic soils large areas of wheat, sweet potatoes, potatoes, peanuts, turnips, millet, rye, and other crops. Industrial crops such as tea, tobacco, ramie, the silkworm mulberry, medicinal herbs, and the like, have also been cultivated in large acreage on the lateritic soils. Fruit trees such as peaches, pears, loquats, oranges, etc., have also been grown.

At the same time the breeding of dairy cattle, hogs, woolly rabbits and honey-bees has been developed. Other sideline productions and processing have also become considerable achievements. For example, the affiliated farm of the Provincial Agricultural Bureau was founded in 1952. In 1953 its income and expenditures were nearly balanced and in 1954 the farm showed a profit of more than 2,400 yuan. The profit has since been increasing year after year.

On the basis of statistics for 1952 to 1957, the gross income from production during that six-year period not only wiped out the loss incurred during the first two years but also left a profit of more than 15,500 yuan. The profit in 1957 alone amounted to 7,200 yuan.

Again, for example, the State-operated Liu-chia-chan Farm was founded in 1956; and after two years of hard work, its income and expenditures were almost balanced in 1957. This year [1958] the slogan of the farm is "Conquer the red earth, leap forward on all fronts, increase production twofold, and have a profit of 50,000 [yuan]."

Since the liberation, the masses have also made tremendous achievements in the utilization of the lateritic soils. For example, in the red earth hilly areas of Chin-hsien, Feng-ch'eng, Lin-ch'uan and other hsien, the people did not use improved cotton seeds, as in the past. They planted only domestic cotton which yielded only 30 to 40 chin of "Tzu" cotton [literally, seed cotton] per mou. In recent years, they have changed to "Hsi-jung" cotton [literally, fine flossy cotton] and the yield of "Tzu" cotton has jumped to about 150 chin per mou.

The yields of other crops have also increased. For example, the yield of wheat reaches 200 chin per mou, that of sweet potatoes, 5,000 chin per mou and that of peanuts, 250 chin per mou. This represents a one-to two-fold increase over the pre-liberation production.

During these several years, armed with these eloquent facts of production increases, we have vanquished the various absurd ideas of the old society on the uselessness of the red earths. All the peasants in the entire province have come to realize that "there are no poor soils, but only poor farming methods," and that "there are no excellent lands, but only excellent cultivation." The courage and confidence of the masses in the exploitation of the red earths has thus been greatly strengthened.

At present, we have adopted measures such as transforming waste lands into cultivated fields, changing arid lands into irrigated fields, and completing two seasons of work in one season, on the basis of the Party's general line of socialist construction.

This was based, in turn on the principle of "consolidate all efforts, strive to forge ahead" and "more, faster, better and cheaper," on the slogan, "double our efforts, with a big leap forward on all fronts and a ten-year plan to be completed in five years," which had been adopted by the Provincial Committee.

Within the Second Five-Year Plan we expect an increase of 8,500,000 mou of cultivated land (7,000,000

mou to be opened up by State-operated farms; 1,500,000 mou by the agricultural producers' cooperatives).

At the initial stage of reclamation, on the basis of a yield equivalent to 300 chin of food-grain per mou, the entire reclaimed fields may then add to the nation's coffer more than 2,500 million chin of food-grain per annum. (The yields of industrial crops are not included and should be much higher than the given figure. Besides, production can be raised year after year.)

It is evident, therefore, that the lateritic soils are neither barren lands nor rat holes without any prospect of yielding a profit. Through rational utilization and improvement, they can be converted into fertile soils. The lateritic soils are of tremendous importance to socialist construction.

IV. How To Convert Lean Lateritic Waste Lands Into Fertile Farm Lands

Kiangsi is by nature a land of plenty with a warm climate and fertile soils. However, in the vast expanse of the lateritic hilly lands which were subjected to severe abuses and destruction during the reign of the reactionary regime, trees do not grow, the loss of water and soil is serious, and the fertility of the soil is getting worse.

Consequently, these areas have become an extensive tract-of waste lands. They have produced nothing, and have only brought the people the ravages of numerous avoidable droughts and floods.

In order to improve and raise the living standards of the broad mass of people and to aid and support the nation's socialist construction, the people of the entire province have now made up their minds to use their hands to transform the bleak appearance of these hilly lands; they have launched an attack on the lateritic soils. They expect to turn the wild mountains into orchards and the waste lands into fertile fields within five years or sooner. The above has become a slogan to guide the actions of the masses.

But, how can these lean lateritic waste lands be converted into fertile farm lands? The experiences of the various State-operated farms and the peasants of Kiangsi in the utilization and improvement of the lateritic soils are as follows:

1. The combination of agriculture, forestry, animal husbandry and other subsidiary occupations is an effective approach in the utilization of the lateritic soils:

The lateritic waste lands suited for agricultural reclamation purposes generally are hills distant from mountains and streams, and they are called the "tortoise-back lands" by the masses. Where the inclination is less than 15° , almost the entire hill can be cultivated.

However, because of the difference in topographical positions, the thickness, the moisture and the texture of the soil vary greatly along the slope from top to bottom.

Generally speaking, the soil on the top of the hill is thinner and contains more gravels and less moisture. It is only good for green-manure crops or the cultivation of some forage crops.

In the central and lower parts of the hill, the soil horizon becomes looser, thicker, and more fertile; if soil and water conservation work is properly maintained, it may produce various crops adaptive to lateritic soils. In low and level areas where water is available, terracing may be practised and paddy rice may be grown.

Where the inclination is more than 15° , the soil at the top of the hill is not only thin but also readily eroded after cultivation, because of the steepness of the slope.

Therefore, it is most ideal for afforestation. When the trees spring up, they will help conserve water and soil, protect the area against wind and drought, and also beautify the surroundings.

At the beginning of the development of the lateritic soils, the most pressing problem is how to achieve speedy results, and additional income and profits, with only a small investment.

First of all, we should consider operational policies on the basis of the characteristics of the lateritic soils and the special features of the region. Since the lateritic soils have inferior physical and chemical

properties, due to deficiency in organic matter, these reclaimed lateritic waste lands are only suited to the cultivation of sweet potatoes, peanuts, rye, "Tzu-kua" [probably, a kind of melon], turnips and the like. Their yields can hardly be high.

However, all these crops should be used to raise a large number of hogs, and to increase the fertility of the soil. Hog excrement may be used as manure; then the yield of the crops in the following year would at least be doubled.

It is evident, therefore, that the combination of agriculture and animal-husbandry is the basic means of solving the deficiency of organic matter in the lateritic soils, or that it is the key to success or failure in the utilization of the lateritic soils.

According to the experience of the State-operated Liu-chia-chan of Kiangsi, the optimum ratio between agriculture and animal-husbandry is generally 2:1 or 3:1, that is, two to three mou of land per hog. Thus, the manure from each hog pen would basically satisfy the requirements of forage.

In agricultural operation, attention should be given to the combination of the different varieties of crops, especially the proportion between the annual and the perennial crops, for the following reasons:

The perennial industrial [shoubs and] trees such as tea, fruit trees and silkworm mulberry trees, etc., are suited to the lateritic soils and their commercial values are very high. The income from one mou of orchard land is equivalent to that of a dozen or so mou of the other type of land. But these industrial plants require heavy investment and a longer period of time to bring in results.

Therefore, in the formulation of the development plan, the actual financial conditions should be taken into account, in order to avoid the mistake of having an over-ambitious scheme which lacks sufficient funds for effective performance.

The rate of development of animal-husbandry is primarily determined by the area of the forage bases and the yield of forage crops. In addition to the extensive development in the breeding of cattle and hogs, the raising of wool-producing rabbits, fine-woolly sheep, honey-bees, poultry, and so forth, should be vigorously expanded in the province.

Since the period of production in raising livestock is short, the profit is high; the circulation of funds is fast; thus, more capital may be accumulated and then invested to improve the soil and to satisfy the requirements of capital constructions.

Furthermore, subsidiary production should receive proper attention, not only because many agricultural products, after being processed, would increase their economic values, but because the by-products would also be properly utilized. The processing of oils and fats, food-grains, tuber and root crops falls into this category.

Finally, in the exploitation of the lateritic soils, it is only through adopting a policy based on a combination of agriculture, forestry, livestock-breeding and subsidiary production that the land may be judiciously utilized, that revenues may greatly increase, and that agriculture and forestry, on the one hand, and animal husbandry and subsidiary production, on the other, may mutually aid each other.

Production with a rapid return should support those with slow returns; those which yield returns in the current year should support those which do so only after the lapse of many years. One final step forward would be to achieve the goal of unified coordination, mutual assistance and the ideal of "more, faster, better, cheaper."

2. The policy of "simultaneous utilization and improvement" is the only one that can shorten the maturing process of the waste lands and constantly improve the fertility of the lateritic soils:

The low fertility and inferior tillage of the lateritic soils may be due to the inherent deficiencies of the soils, but improper cultivation is also an important cause. In the past, the lateritic soils were considered too poor to grow crops and only good enough for gulfweed; the lateritic soils were "rat-holes" which would not yield enough to cover even the cost of the seeds. Evidently, all these absurd assertions were due to the inability to formulate correct agricultural methods.

Experiences in utilizing the lateritic soils in Kiangsi during the past few years have ascertained the fact that the policy of "simultaneous utilization and improvement, aiming at production" can shorten the maturing process of the lateritic soils and constantly improve the fertility of the soils at the same time.

In most of the newly developed lateritic waste lands in Kiangsi, the autumn-winter crops--as well as the early spring crops--generally yield good harvests. However, owing to the effects of summer drought, the yields of the spring and the summer crops are most irregular.

If one does not have a thorough understanding of this very point and is suddenly confronted with a reduced yield or complete failure of the autumn-harvested crops, one is bound to commit the mistake of being unrealistic by concluding that the lateritic soils are useless until improved.

On the other hand, exclusive emphasis on utilization without proper attention to improving the soil will certainly result in a failure to increase the productivity of the soil and will also create the possibility that the gain will not cover the loss.

After several years of production experience, we have learned to solve this problem step by step through the wisdom acquired from the experience in "simultaneous utilization and improvement." For example, in the newly reclaimed waste lands, the annual yield of rye, sweet potato residues and vines, peanut vines and shells, turnips, the rinds of "Tzu-kua", and other green-manure crops and succulent, green forage crops is approximately 3,000 chin per mou.

With these products, every two mou of land can support a hog. At the same time, the accumulation of manure from a single hog pen amounts to 50 tan of excrement and urine per annum. This amount of excrement from one pig is then combined with green grasses, tender leaves, pond mud, refuse, etc. to form a compost pile, which would be sufficient to provide the basic nutritive requirements of three to four mou of land.

In addition, green-manure farming should be extensively practised and various measures should be promoted to improve the soil. In this way the lateritic soils may be basically matured within three to five years.

There are many instances of practical results which have derived from this method of "simultaneous utilization and improvement" based on a combination of agriculture and animal husbandry. The following table depicts only the general conditions in the farms affiliated with the Provincial Agriculture Bureau:

Period of Utilization	Crop Yield (chin/mou)		
	Rye	Peanuts	Sweet Potatoes
Newly Reclaimed Waste Lands	86	92	700
Lands Utilized 3 Years	150	203	1,380

Soil Fertility (%)			
Organic Matter	Nitrogen	Phosphates	Amount of Water Retained in Field
0.31	0.0299	0.0388	16.3
1.61	0.0863	0.0520	21.3

3. Several simple, easy and effective, technical, measures:

(1) Adapting the crops to the lateritic soils. The lateritic waste lands are low in natural fertility. Therefore, at the initial stage of reclamation, not all crops can thrive. On the basis of the results of production practice by the masses and the various State-operated farms, crops suitable for lateritic soils include rye, sweet potatoes, potatoes, "Tzu-kua", water melons, "Fan-tou" [literally, rice beans or peas], green peas, peanuts, tobacco, turnips, wheat, barley, millet, rape, etc. Rye, peanuts and sweet potatoes are the most adaptive of those cited.

As a whole, the more sandy lateritic soils are suitable for the cultivation of water melons, peanuts and turnips, whereas the more clayey varieties are suitable to that of rye, sweet potatoes and tobacco. Sesame and millet, which require short growing periods, and which can grow three crops a year, are short-term drought-resistant crops fit for planting during the summer drought season.

Potatoes require more fertilizer but grow well in lateritic soils. If a compost pile of 60 tan, to which 40 chin of superphosphate has been added, is applied to one mou of land, a high yield of 2,000 chin of potatoes per mou may be achieved.

After the lateritic soils have become mature, cotton, sugar cane, rape, soya beans, jute, ramie and other industrial crops can be grown. Among the winter varieties of the green-manure and forage crops suitable for planting on the lateritic soils, the soil-improving turnip is the best; "T'iao-tzu," and green peas are the next best; milk vetch and "Chin-hua-ts'ai" [literally, golden flower vegetable] are not so good.

Though most of the annual summer green-manure crops grow on the lateritic soils, they readily become woody. Besides, some varieties do not even produce. Among those that are well adapted to the lateritic soils, the "Ta-yeh-chu-shih-tou" [literally, the large-leaved hog excrement beans] is the best, "Fan-tou," mungbeans and "Kou-chao-tou" [literally, dog's claw beans or peas] are the next best. Of the perennial green-manure and forage crops, windgrass, rye grass, creepers and "Hu-chih-tzu" are the best adaptive.

Fruit trees growing on the lateritic soils include oranges, peaches, pears, and loquats. Peach, pear and loquat trees start to bear fruit four to five years after planting. The "Shui-mi-t'ao" [literally, juicy sweet peach] of Wu-chiang begins to yield 78 chin per tree nine years after planting.

Other varieties of pear trees, such as "Shang-yao-ma-k'o," "Huang-p'i-shao," and "T'ai-pai" are well-fitted to the lateritic soils. Of the oranges, the Wen-chow and Nan-feng tangerines are the best, and have been successfully grown on farms bearing lateritic soils.

Trees that are adapted to the lateritic soils include *Pinus massoniana* Lamb, "K'u-lien" [probably related to *Melia azederach*], "Ho-huan" [a tree similar to the acacia], "Feng-hsiang" [possibly, maple], "Mu-ho," "An-shu," and other trees. Industrial trees such as the oil tung, oil tea, chestnut, camphor tree and others also thrive on the lateritic soils.

(2) The use of organic fertilizers and the improvement of fertilizer practices.

Organic fertilizers are the principal key in expediting the maturing process of the lateritic soils and in raising the crop yield. Without the combined use of

both organic and inorganic fertilizers in the newly developed lateritic waste lands, it is impossible to bring about the expected crop yield through the exclusive use of chemical fertilizers.

Before becoming unaware of the important functions of organic fertilizers in the lateritic soils, the Provincial Agriculture Bureau adopted the "fit the remedy to the disease" method on the basis of the physical and chemical properties of the soils. In the large fields, 50 chin of lime per mou were used to neutralize the acidity of the soil: 10 chin of ammonia sulphate and 20 chin of superphosphate per mou were added in order to supplement the deficiency of the phosphorous and potassium nutrients in the soil. [However, the result was most disappointing.] The yield of peanuts was only 15.3 chin per mou and that of sweet potatoes, more than 200 chin per mou.

Subsequently, a composite compost pile of 1,000 chin was used on the above-stated basis of using both organic and inorganic fertilizers in addition to chemical fertilizers.

As a result, the yield of peanuts increased to 120 chin per mou and that of sweet potatoes, to 1,500 chin per mou. Similar results were achieved in experiments on wheat and rye.

There are many kinds of organic fertilizers, but those which are easily and abundantly available in the lateritic hilly regions are very few indeed. To solve this problem, the judicious employment of fertilizers is also very important, in addition to soil-improving methods such as hog-raising, in building up manure, green-manuring and piling up compost.

The improvement of fertilizer practices calls for the judicious employment of fertilizers, by which means a small quantity of fertilizer may exert the maximum fertilizing effects and bring about a marked increase in crop yield. The best fertilizer practices are concentrated placement of the fertilizer, combination of fertilizers, and frequent application of the basic nutrients.

The advantage of concentrated application of the fertilizer lies in providing the roots of the plant with excellent nutritive conditions and reducing the contact area between the soil and the fertilizer, thus eliminating the fixation of the available nutrients by the soil.

The combination of fertilizers involves the preparation of compost pile according to a definite ratio

of organic and inorganic matter. The former should have undergone rapid decomposition by micro-organisms while in the pile, in order that the fertilizing effect might be improved.

The purpose of frequent application of basic nutrients is to maintain a steady supply of nutrients to meet the requirements of the plant during its entire growing season, so as to eliminate its deficiency symptoms.

Experiments have pointed out the following facts: strip application of fertilizer raises the yield of sweet potatoes 27 percent more than does broadcast application and hole application--23.5 percent more than does strip application; the combination of fertilizers (that is, the use of 2,000 chin of compost pile, 10 chin of superphosphate, 24 chin of ground phosphorous-bearing rocks, 37 chin of lime per mou of land) raises the yield 10 percent more than does the usual fertilizer practice (2,000 chin of compost pile and 35 chin of "K'u-ping" [literally, a cake made of dried materials]).

(3) Do well in soil and water conservation and in drought prevention work.

The annual rainfall in Kiangsi, though heavy, is most unevenly distributed throughout the year. During the rainy season, March to June, the rainfall is as great as 800 to 900mm, or more than 50 percent of the annual amount.

It decreases gradually after July, after which the drought season sets in--lasting from August to October. During this period the rainfall is only 300 to 350mm whereas the evaporation capacity amounts to 700 to 800mm.

Therefore, soil erosion due to excessive rainfall between spring and summer and the long drought period due to scanty rainfall, between summer and autumn are the two most serious threats to agricultural production in the hilly regions. The rainy season and drought season follow each other in Kiangsi; therefore, if the work on soil and water conservation can be successfully performed during the rainy season, then the problem of drought in the subsequent period would be automatically eliminated or lessened--and the yield of the crops assured.

In an effort to perform soil and water conservation and drought prevention efficiently, the masses of Kiangsi have constructed lakes and ponds, reservoirs,

wells and other engineering works; they have cultivated the early-ripening and drought-resistant varieties of crops; they have increased the use of organic fertilizer in order to improve the lateritic soils fundamentally. In addition, they have also adopted the following measures:

(A) Contour cultivation and strip catch cropping.

Contour cultivation refers to tillage across slopes. It features plots and small ditches alternating with each other and crossing the slope approximately on the contour. The ditches are dug at intervals of five to ten ch'ih, and their soil is used to augment the plots. Crops are planted in rows according to definite spacing.

In this way, the bank along the downhill edge of the plot and the roots of the crops can effectively check the loosening of the soil, and the narrow ditches can either store or drain off excessive rainwater. Thus the purposes of soil and water conservation are served.

Strip catch cropping is modeled after contour cultivation. For example, in a strip of wheat, early-ripening soya beans may be sowed in April in the wheat rows; at the harvest time of the wheat the soya bean seedlings are well developed and their branches and leaves can cover and protect the land surface. Corn or sweet potatoes may then be planted together with the beans; at their harvest the young plants of the other crop are, in turn, also well-grown.

By this means, the soil in the field is constantly covered with the leaves of crops from early spring to late autumn, and the loss of soil and water may thus be arrested (Figs 2 and 3).

Figure 2. Contour Cultivation



1. Contour Strip Sowing

2. Contour Plots



3. Contour Banks



4. Contour Hewing

Figure 3. Strip Catch Cropping



1. Regular Spacing



2. Wide and Narrow
Spacing

(B) Construct banks, preserve grass strips and build terraces.

On the strongly sloping waste lands, the construction of banks is a practical means of conserving soil and water. The bank is usually one ch'ih high and two ch'ih wide. It can intercept the surface runoff and serve as a path in the field. The shallow drainage depression on the [uphill] side of the bank may be opened to drain off the accumulated water during the rainy season, and the openings may be blocked to store rainwater during the drought season.

On the uphill side of the bank and at a certain interval along the shallow depression, a trench is dug to receive sand deposits and to reduce soil erosion.

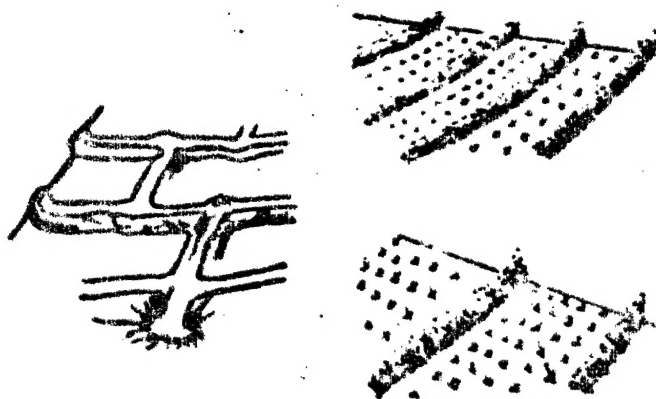
The left-over grass strips are a part of the grasslands which have been preserved on the contour, and which have not been turned under since the opening up of the waste lands. They form effective soil-protecting green strips. The width of a grass strip and the distance between any two of them should be determined by the gradient of the slope.

In general, the grass strips should be wider on steeper slopes and narrower on gentler ones. In addition to green-manure and forage crops, tea shrubs and fruit trees may be planted on the grass strips.

Where the inclination is greater than 15° , the practice of terracing should be employed. A terrace may be constructed by digging up the uphill side of a strip of land--the soil always thrown toward the downhill side--so that a more or less level bench or terrace is formed.

In areas with an abundant water supply, the terraces may be flooded and become paddy rice fields (see Figure 4).

Figure 4. Construction of Banks (left), Preservation of Grass Strips (right)



(C) Dense planting, frequent hoeing and banking up the soil.

Dense planting is an effective way to increase production, since, in addition to its direct influence on increasing the total yield of the crops, it also effectively covers in covering the ground, holding the soil firmly together, and preventing soil erosion and the loss of fertilizers and soil nutrients.

Frequent hoeing counts heavily in the newly opened lateritic arid lands, because the immature lateritic soils are heavy, readily become platy, and, therefore, not too well suited to crop growth. Frequent hoeing breaks up the soil into fine fragments, thus imparting proper degree of aeration to the soil and increasing power to retain water and nutrients.

Particularly after the rain, a loose soil breaks the crust at the surface, blocks up the capillary tubes in the soil, and thus prevents excessive water evaporation.

Banking up with soil tends to enlarge the nutrient area for the roots of the crops, so as to store up greater amount of moisture and enhance the drought-resistant ability of the plants.

(D) Deep plowing in winter, shallow plowing in summer and no plowing in spring.

This particular type of plowing practice is derived from the experience of the masses and is necessitated by climatic conditions in Kiangsi. Deep plowing is recommended for winter, during which time the rainfall is scanty and soil erosion is less likely to occur. Furthermore, the deeply turned-over soil is good for the roots of the plant and also increases the retention of water in the soil. It has other advantages too.

Shallow plowing is recommended for summer in view of the fact that, after the rain, shallow plowing would loosen the soil and thus reduce water evaporation.

No plowing is favored for spring, mainly because rainfall is heavy in spring; the soil would be readily washed away, if plowed when loose and soft. For this reason, the masses have stopped plowing the land in spring and instead have adopted the practice of catch cropping (also called "cultivation in a series") in an effort to struggle against nature.

By this means, the ground surface will be constantly covered with the branches and leaves of crops from spring to autumn and the soil will be firmly held together by the roots of the crops. Hence, soil erosion will be prevented and the drought-resistance of the soil will be increased.

FOR REASONS OF SPEED AND ECONOMY
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